

**2nd Annual Symposium
Toward a Global Earth Observation System of Systems
Future National Operational Environmental Satellites**

**Calibration/Validation of the NPOESS NPP
Instruments:
Plan Overview**

**Dr. Karen St. Germain
NPOESS Integrated Program Office**



NPOESS' 55 EDRs-to-Sensor Suites Mapping

MISSION AREAS

- Atmosphere
- Land
- Space Environment
- Climate
- Ocean

- ALBEDO (SURFACE)
- CLOUD BASE HEIGHT
- CLOUD COVER/LAYERS
- CLOUD EFFECTIVE PART SIZE
- CLOUD OPTICAL THICKNESS
- CLOUD TOP HEIGHT
- CLOUD TOP PRESSURE
- CLOUD TOP TEMPERATURE
- LAND SURFACE TEMP
- SURFACE TYPE
- Net Heat Flux
- Ocean Color/Chlorophyll
- SUSPENDED MATTER
- VEGETATION INDEX

VIIRS (22)

- AEROSOL OPTICAL THICKNESS
- AEROSOL PARTICLE SIZE

APS (4)

- Aerosol Refractive Index, Single Scatter Albedo, Shape
- Cloud Particle Size/Distrib

Solar Irradiance

TSIS (1)

CMIS (16)

- Ice Surface Temperature
- IMAGERY
- Sea Ice Characterization
- SNOW COVER/DEPTH
- SEA SURFACE TEMPERATURE
- SOIL MOISTURE

- CLOUD LIQUID WATER
- PRECIPITATION TYPE/RATE
- PRECIPITABLE WATER
- SEA SURFACE WINDS
- CLOUD ICE WATER PATH
- Surface Wind Stress
- TOTAL WATER CONTENT

- ATM VERT MOIST PROFILE
- ATM VERT TEMP PROFILE
- PRESSURE (SURFACE/PROFILE)

CrIS/ATMS (3)

- O₃ Total Column (also CrIS)

O₃ Profile (OMPS Only)

OMPS (1)

- Auroral Boundary
- Auroral Energy Deposition
- Auroral Imagery
- Electric Fields
- Electron Density Profile
- Energetic Ions
- Geomagnetic Field
- In-situ Plasma Fluctuation
- In-situ Plasma Temp
- Ionospheric Scintillation
- Med Energy Chgd Parts
- Neutral Density Profile
- Supra-Therm-Aurora Prop

SESS (13)

- Down LW Radiance (Sfc)
- Down SW Radiance (Sfc)
- Net Solar Radiation (TOA)
- Outgoing LW Rad (TOA)

ERBS (4)

- OCEAN WAVE CHARACTERISTICS
- Sea Surface Height

ALT (2)

KEY

Underlined = NPP EDRs (25)

= NPOESS Key Performance Parameters

BOLD CAPS = LRD Environmental Data Records

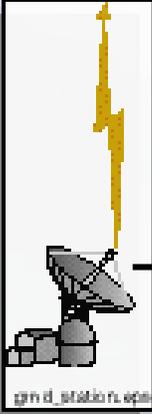
02 January 2006

DOC, NOAA, NESDIS,
Integrated Program Office
D. Pierce, M. Haas, S. Mango,
J. Schaeffer, J. Whitcomb
Northrop Grumman
L. Wait



Philosophy of Calibration/Validation

Cal/Val



Calibration

- Absolute Accuracy
- Polarization Purity
- Geolocation Accuracy
- Instrument Stability
- Signal-to-Noise
- Antenna Pattern Correction

Validation

Environmental Data Products (EDRs)

- Atmosphere
- Ocean
- Land
- Ice
- Space

Ensures

Mission Success

- Meet Specification
- Operational production of synoptic maps and profiles of critical atmospheric, oceanographic, land and space parameters
- Known Accuracy
- Quality Control

Users

- Centrals
 - NWP
- Real-time tactical
- Non-tactical
 - JTWC
 - NHC
 - JIC
- Science
- Others

Calibration ensures that the Sensor Data (SDRs) are usable
Validation ensures that the Environmental Data (EDRs) are usable

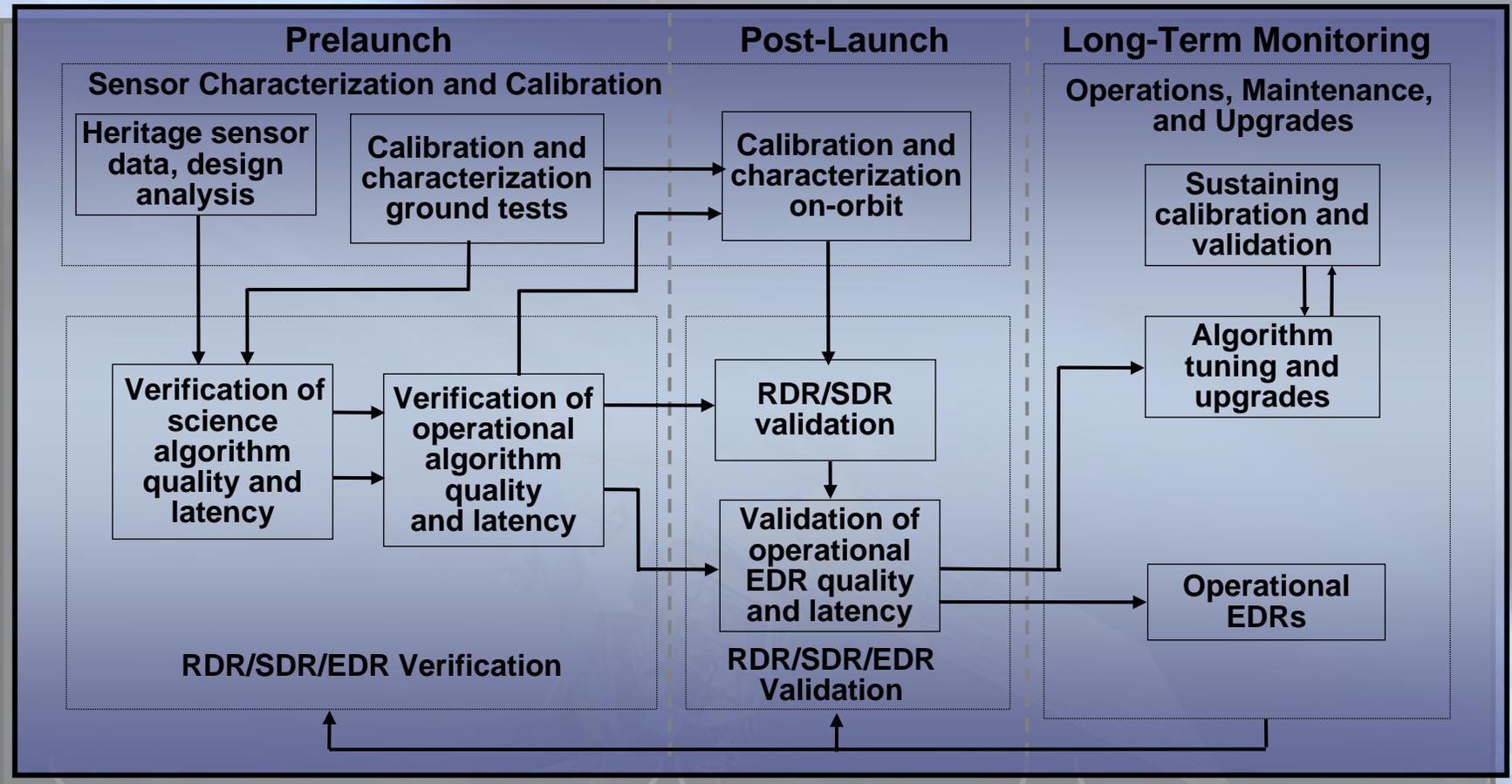


The Stakeholders





NPOESS Calibration Verification Validation Program- System Perspective



Hotbed of Activity

Intensive Planning and Tool Development Effort Underway

Planning Underway



NPP Cal/Val Complexity

- **26 EDRs**
- **4 New Instruments**
- **3 Resource Management Centers**
- **Pre-launch tests occurring at 4 different sensor vendors**
- **How are we managing this?**
- **How do we know our plans are comprehensive?**

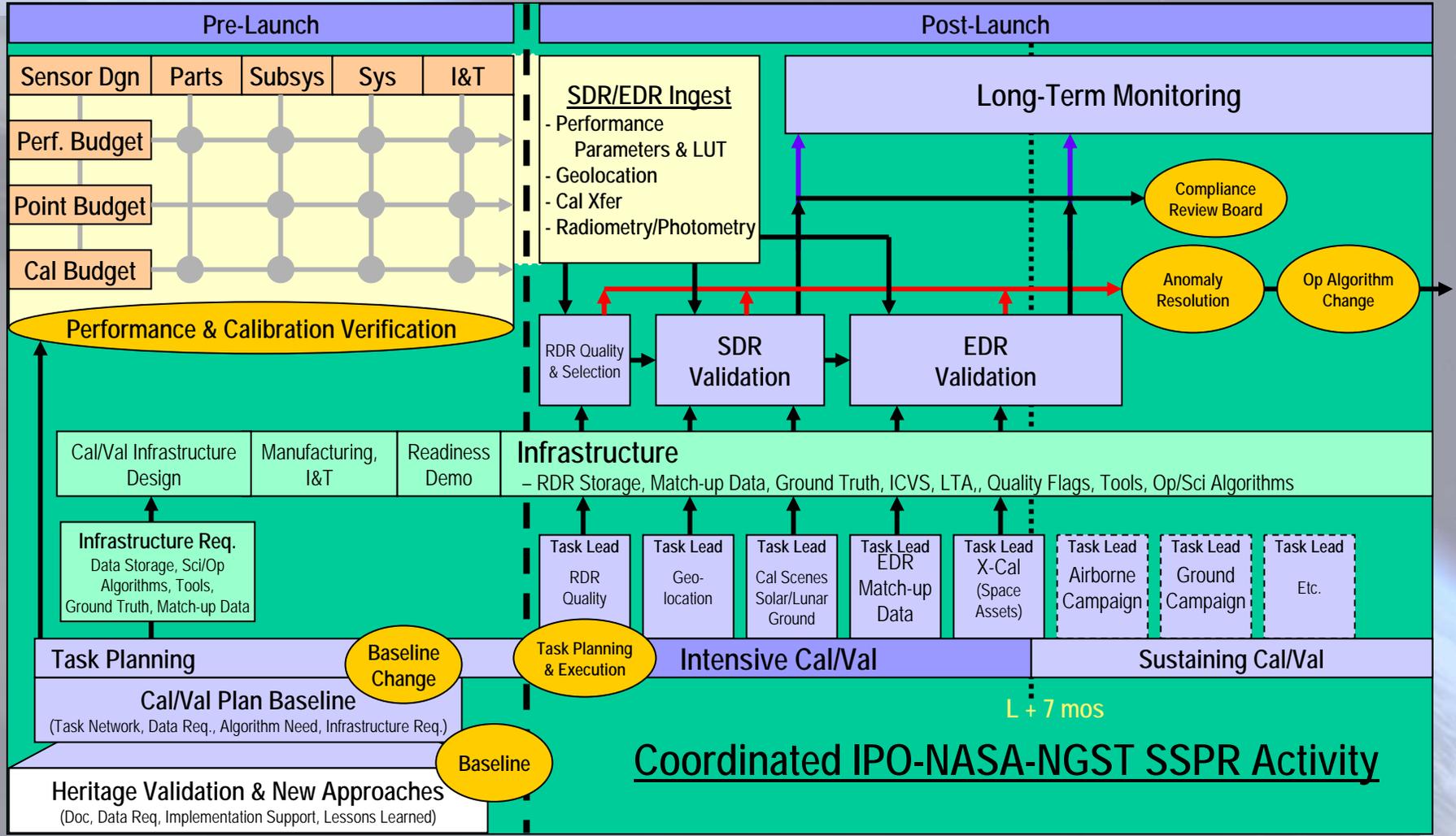


Coordinated NPP Cal/Val Plan Baseline and Changes

- **Coordinated NPP Cal/Val Plan Baseline**
 - The SSPR Prime contractor, the Integrated Program Office, and the NAS NPP Science team have a (mostly) common interest in executing a successful Cal/Val
 - SDR/EDR Compliance-to-Cal/Val Requirement system engineering (with Science and Technical Advisors involvement) will identify tasks that are must, specific, realistic, and measurable. A Tasks Network will be used to explore schedule constraints and clearly define task responsibilities
 - The CVMT and Science/Technical Advisors are responsible for constraint management
 - Looking for synergistic tasks. Exploring parallel task execution options
 - Identifying discrepancies in bottom-up schedule, budget and Goals
 - Using priorities to explore trade-offs
 - Using NPOESS SCB and NETS to resolve schedule and budget gaps
 - From the Task Network the CVMT will establish roles and responsibilities among performing organizations
 - The CVMT will manage execution of the Joint NPP Cal/Val Plan baseline
- **Joint NPP Cal/Val Plan Baseline changes**
 - The CVCCB will manage baseline changes employing traditional CCB processes and documentation



NPOESS NPP Cal/Val "Big Picture"



Coordinated IPO-NASA-NGST SSPR Activity



"Bottom Up" approach to defining Cal/Val

Driven by diagnostic work that has to be done in the intensive post-launch phase

CasaNOSA: Browse Tasks For: Invalid User ID By Status: Open

https://casanosa.noaa.gov/pm/task.php?func=browse&group_project_id=147&set=custom&assli

Logged In: kstgermain

Project List | Add Task | My Tasks | Browse Open Tasks | Admin

Browse Tasks by User and/or Status:

Subproject: NPP Post Launch Assignee: Any Status: Open Keyword Sort: Off

Browsing Custom Task List In NPP Post Launch

Task ID	Summary	Start Date	End Date	Percent Complete
769	VIIRS M/T SDR LUT Calculate and Upload	2004-08-16	* 2004-08-16	0%
770	VIIRS M/T SDR Algorithm Modification	2004-08-16	* 2004-08-16	0%
771	VIIRS M/T SDR Moon in Space View Correction	2004-08-16	* 2004-08-16	0%
772	VIIRS M/T SDR Comparison with MODIS	2004-08-16	* 2004-08-16	0%
773	VIIRS M/T SDR Climatology Comparison	2004-08-16	* 2004-08-16	0%
774	VIIRS M/T SDR Band-to-Band Radiometric Comparison	2004-08-16	* 2004-08-16	0%
775	VIIRS M/T Yaw Maneuver	2004-08-16	* 2004-08-16	0%
776	VIIRS M/T Roll Maneuver	2004-08-16	* 2004-08-16	0%
777	NPP Thermal Analysis	2004-08-16	* 2004-08-16	0%
778	VIIRS M/T Pitch Maneuver	2004-08-16	* 2004-08-16	0%
779	VIIRS M/T Yaw Maneuver Analysis - Screen Transmission	2004-08-16	* 2004-08-16	0%
780	VIIRS M/T Roll Maneuver Analysis	2004-08-16	* 2004-08-16	0%
781	VIIRS M/T SDR Pitch Maneuver Analysis	2004-08-16	* 2004-08-16	0%
782	VIIRS M/T SDR Accuracy Evaluation	2004-08-16	* 2004-08-16	0%
783	VIIRS SST Comparison with Reynolds Fields	2004-08-16	* 2004-08-16	0%
784	VIIRS SST Truth Data Quality Control	2004-08-16	* 2004-08-16	0%
785	VIIRS SST Generate Matchup Database with Truth Data	2004-08-16	* 2004-08-16	0%
786	VIIRS SST Stratify Residual Differences	2004-08-16	* 2004-08-16	0%
787	VIIRS SST Algorithm Tuning	2004-08-16	* 2004-08-16	0%
788	VIIRS M/T SDR Stabilized Algorithm and LUTs	2004-08-16	* 2004-08-16	0%
789	OMPS Digital Numbers in Range Check	2004-08-17	2004-08-30	0%
790	OMPS Physical Temperatures in Range	2004-08-19	* 2004-08-19	0%
791	OMPS Bad Pixel Check	2004-08-19	* 2004-08-19	0%
792	OMPS Light Leak Check	2004-08-19	* 2004-08-19	0%
793	OMPS SDR Functional Data Flow Check	2004-08-19	* 2004-08-19	0%
794	OMPS EMI/EMC Check	2004-08-19	* 2004-08-19	0%
795	OMPS Charge Transfer Efficiency (CTE) Check	2004-08-19	* 2004-08-19	0%
796	OMPS Dark Current Check	2004-08-19	* 2004-08-19	0%
797	OMPS Bad Pixel Baseline	2004-08-19	* 2004-08-19	0%
798	OMPS Dark Current Baseline	2004-08-19	* 2004-08-19	0%



Tasks are captured in a web-based relational database

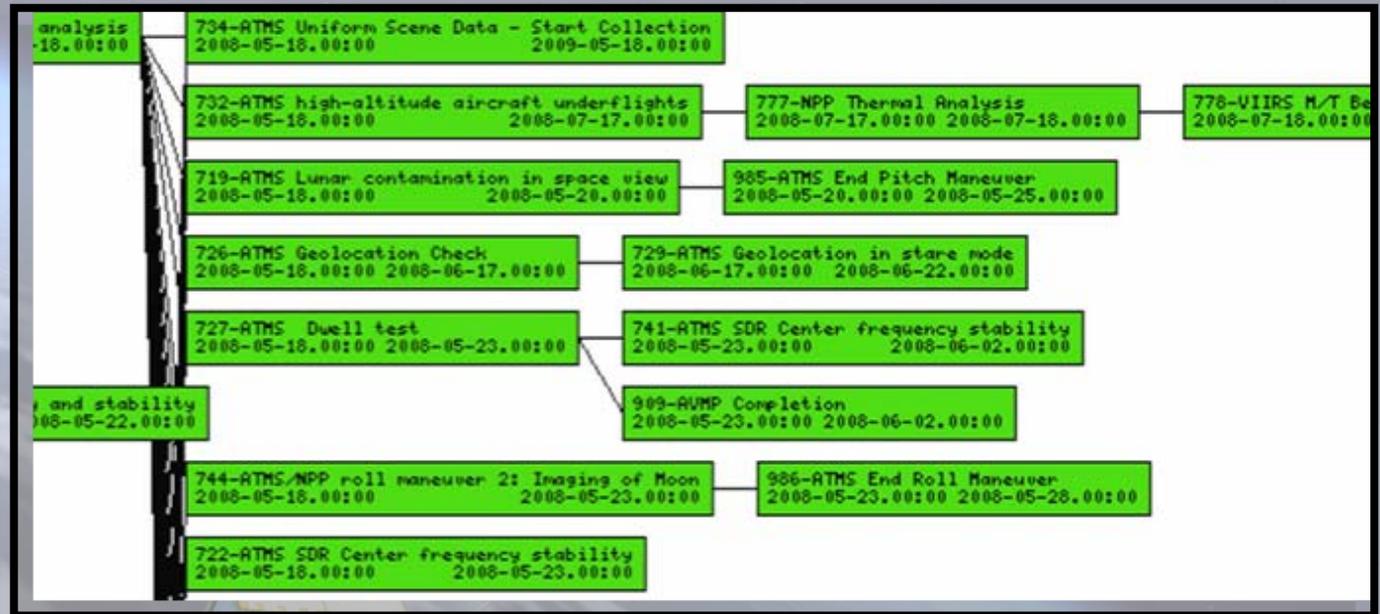
- Attributes include Data, metadata, tools, entry and exit criteria, etc.

The screenshot shows a Mozilla browser window with the URL https://casanosa.noaa.gov/pm/task_details.php?project_task_id=908. The page title is 'CasaNOSA: Task 908: CrIS Self Emission and Background Radiance - Sensor Checkout - Mozilla'. The browser's address bar shows the URL and search, print, and home icons. The page content includes the CasaNOSA logo, a navigation menu, and a sidebar with links like 'Logged In (single)', 'Project: NPOESS Cal-Val Technical Library', and 'Search'. The main content area is titled 'NPOESS Cal-Val Technical Library - Tasks' and displays details for 'Task 908 in NPP Post Launch'. The task name is 'CrIS Self Emission and Background Radiance - Sensor Checkout'. Below the name are dropdown menus for 'Subjected' (NPP Post Launch), 'Priority' (1 - Medium), 'Percent Complete' (Not Started), and 'Status' (Open). There are 'Submit changes' buttons and a 'Tasks to change' folder icon. The 'Schedule Details' section shows 'Start Date' as June 10, 2008, 'End Date' as July 1, 2008, and 'Schedule Mode' as 'float'. There is another 'Submit changes' button and a 'Schedules to change' folder icon. The 'Description Details' section contains a 'Task Description' text area with the text: 'Get 50m to deep space position with CrIS configured in diagnostic mode for one or more orbits. Monitor CrIS temperature and SW response. Obtain data to characterize orbital variation of CrIS self emission and background radiance/temperature for duration of orbit.' Below the description is an 'Add A Comment' text area.

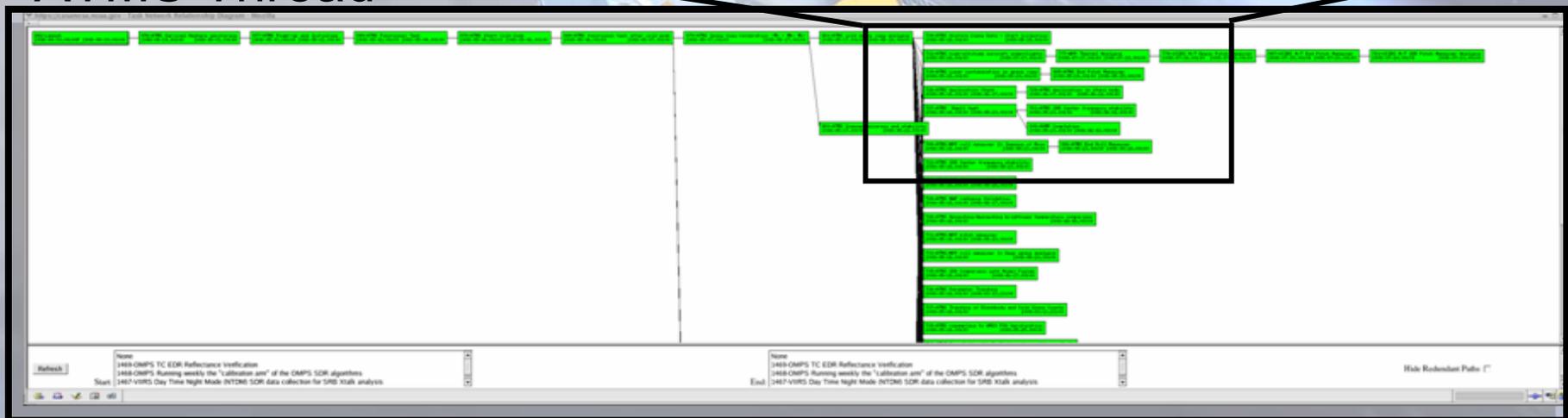


Once described, tasks are linked logically and scheduled

Technical threads are rigorously developed and reviewed by joint teams with individuals from NGST, sensor vendors, Academia, Gov't Labs, and FFRDCs.



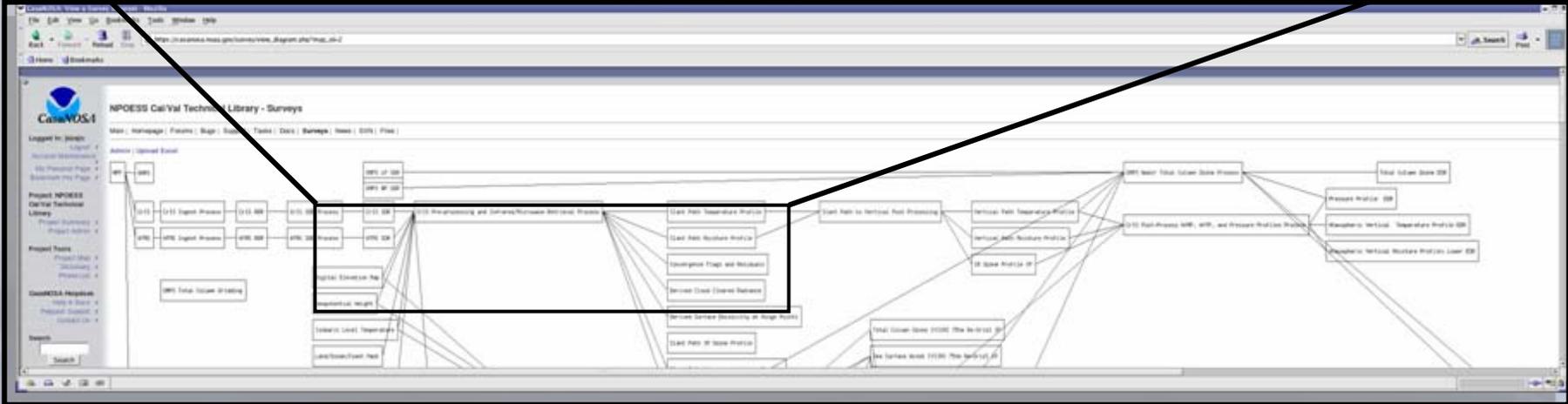
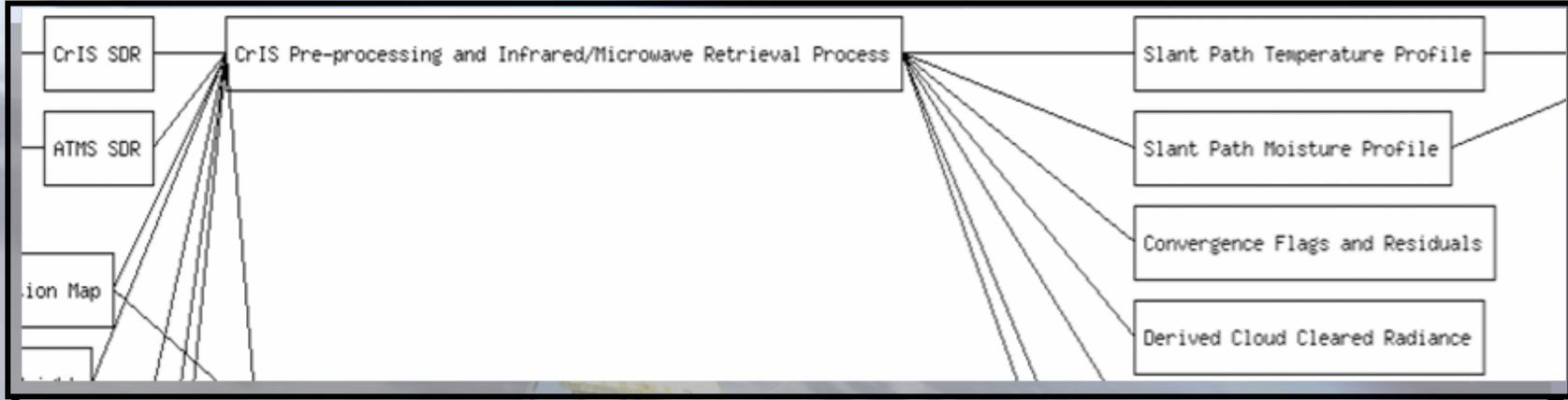
ATMS Thread





A technical library supports the distributed Cal/Val Team

- **Sensor data, analyses, algorithms, formats, tools, reports**





The technical library includes the algorithms and their supporting documentation:

- *ATBDs, code, test data, formats, results, etc.*

CasaNOSA: Project Documentation - Mozilla

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop https://casanosa.noaa.gov/docman/index.php?group_id=126&close_folder=3046 Search Print

NPOESS Algorithms - Documentation

Homepage | Main | Forums | Bugs | Support | **Docs and Data** | News | Source Code | Files |

Submit a document | View Documents | Admin | Package Requests

Project Documentation

Close all folders | Open all folders

- Delivery Documentation (Total contents 1300127331 bytes)
- EDR Algorithms (Total contents 20618792027 bytes)
- IP Algorithms (Total contents 45979372583 bytes)
- Proxy Data (Total contents 309474459163 bytes)
- RDR Documentation (Total contents 7154816 bytes)
- Sample HDF5 Data (Total contents: 524485818 bytes)
 - Documentation on Sample IDPS HDF5 Data**
 - History/ Update/ Forum[0] **Version 1.0 Size 102400 bytes**
Description: Document describing the data that has flowed through the entire IDPS segment, from the CSIE input simulator, Ingest, Infrastructure, Data Management, Processing, and Data Delivery.
 - HDF Data Files Overview**
 - History/ Update/ Forum[0] **Version 1.0 Size 117760 bytes**
Description: Powerpoint presentation describing the Sample HDF5 Data Files
 - Sample IDPS HDF5 Data Spreadsheet**
 - History/ Update/ Forum[0] **Version 1.0 Size 19968 bytes**
Description: Spreadsheet describing the Sample HDF5 data
 - Delivered Data Reports (Total contents 1411 bytes)
 - Example HDF 5 Files (Total contents: 524236472 bytes)
 - AVAFO_NPP_d2003125_t10109_e101038_b6_c2005829155458_dev1_TstLH5
 - History/ Update/ Forum[0] **Version 1.0 Size 4130000 bytes**
Description: VIIRS Active Fires EDR



All code, including algorithms and tools is under configuration control for Cal/Val

CasaNOSA: Subversion repository browsing - Mozilla

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop <https://casanosa.noaa.gov/svn/listing.php?rep=126&path=/VIIRS/IP/Mask/opsCode/trunk/> Search Print

**CasaNOSA**

Logged In: jkzajic
Logout
My account
My Personal Page
Bookmark this Page

Project: NPOESS Algorithms
Project Summary
Project Admin

Project Tools
Dictionary
Phone List

CasaNOSA Helpdesk
Help & Docs
Request Support
Contact Us
Web Services

Search Search

NPOESS Algorithms - Summary

Homepage | Main | Forums | Bugs | Support | Docs and Data | News | Source Code | Files |

npalgs

Path: /VIIRS/IP/Mask/opsCode/trunk/src/
Rev: 163
Last modification: - 2005-07-14 11:31:17 -0400 (Thu, 14 Jul 2005)
Log message:
added branches, tags, and trunk directories to the Mask opsCode/ and sciCode/ directories. Also moved the subdirectories from opsCode/<subdir> and sciCode/<subdir> to opsCode/trunk/ and sciCode/trunk, respectively.

Show changed files

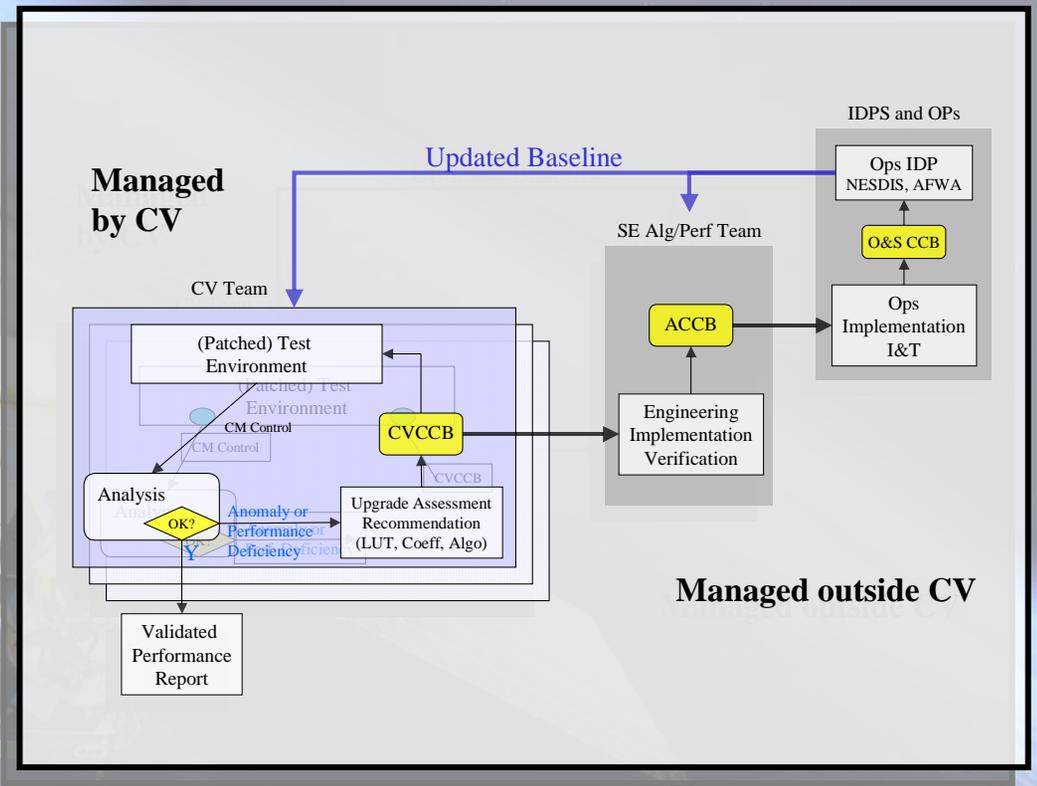
Current Directory: [] [VIIRS/] [IP/] [Mask/] [opsCode/] [trunk/] [src/] - View Log

Path	Log
Aero_Shadow_File.cpp	View Log
calc_VCM.cpp	View Log
Cloud_Adjacency.cpp	View Log
Cloud_Confidence.cpp	View Log
Cloud_Phase.cpp	View Log
coast_day.cpp	View Log
confidence_test.cpp	View Log
confidence_test_2val.cpp	View Log
day_night.cpp	View Log
desert_day.cpp	View Log
iband_Eval.cpp	View Log
Imakefile	View Log
in_t_vcm_flags.cpp	View Log
land_day.cpp	View Log
land_night.cpp	View Log
land_water.cpp	View Log
Process_Path.cpp	View Log



Cal/Val Anomaly Resolution & Ops Change

- The IPO/NASA/NGST SSPR Cal/Val Team will perform analysis and validation of calibration and SDR/EDR performances
- Cal/Val anomalies will be investigated by expert SSPR CV Anomaly Resolution Teams
- Anomaly findings and resolutions will be submitted to the CVCCB for consideration and subsequent recommendation to the ACCB and the O&S CCB for operational implementation



Infrastructure

Data Quality Subsystem

Cal/Val Database

Quality Flags/
Intermediate Products

Analysis Tools

Algorithms and Validation

Validation Data Sources

Validation Data Tools

Internal Gov't Studies

NPP Science Team

OATs Interface

MOUs/MOAs

Cal/Val Activities Today

Pre-launch Testing

Sensor Algorithms (SDRs)

Cal Coefficients/Look-up Tables

NPP Cal/Val Plan

Sensor Calibration

Long Term Monitoring:
Requirements and Tools

S/C Attitude Maneuvers

Transition to O&S

OPSCON Scenarios

Operational Issues



NPOESS Calibration Verification Validation Program Participants

	Exploration & Exploitation Activities	Performance Advisory Activities	Development Activities
IPO & NASA	<p>NPOESS Internal Government Studies</p> <p>NASA NPP Science Team</p>	<p>NPOESS Operational Algorithm Team (NOAT)</p> <ul style="list-style-type: none"> •Science •Algorithms •Sensors 	<p>Integrated Product Teams (IPTs)</p> <ul style="list-style-type: none"> •Systems Engineering (SE, SI, ST&E) •Payloads •IDPS •Operations and Support <p>IPO Cal/Val Team</p>
NGST		<p>NGST Science Advisory Team (SAT)</p> <ul style="list-style-type: none"> •Science 	<p>Integrated Product Teams (IPTs)</p> <ul style="list-style-type: none"> •Systems Engineering (SE, SI, ST&E, Cal/Val) •Payloads •IDPS •Operations & Support <p>NGST Cal/Val Team</p>
	NGST SE IPT Science Team		
Joint	NOESS P³I	NPOESS Customer Forum	
	<p>Calibration/Validation Working Group (CVWG)</p> <p>Calibration/Validation Teams</p> <p>(Participation from Gov't Labs, Universities, FFRDCs, Centrals)</p>		



National Polar-orbiting Operational Environmental Satellite System